Brake Pad Comprising a Retaining Spring Device

The present invention relates to a brake pad comprising a retaining spring device for the detachable mounting support of a brake pad on a piston of a spot-type disc brake and for clamping engagement of the brake pad in relation to the spot-type disc brake.

DE 197 05 803 A1 e.g. discloses a spring element which is not only used to fix the carrier plate of the brake pad in position on the piston but, additionally, to ensure a permanently acting bias between the components concerned (brake caliper, brake carrier, brake pads) so that rattle noises can be suppressed effectively when the brake is not applied. To this end, the prior-art spring element, with a central part having the configuration of a divided circle, is locked into the groove of the piston and includes two arms which are shaped in a mirror-inverted manner. The arms extend from the central part until the radially outward hammerhead-shaped ends of the carrier plate and, close to the end, each have an axially outwards and downwards deflected part. The shaping and the spring force of these spring arms are conformed to one another so that the carrier plate is urged axially against the end surface of the piston and radially against a brake carrier. Due to the fact that the two downwards bent-off parts of the arms achieve that the prior arm spring element makes catch at both ends of the carrier plate and at least in part extend over both ends of the carrier plate, the provision of a special spring element adapted to the configuration of the respective carrier plate is

required. This has limiting effects on the possible adjustments of the bias.

DE 12 23 633 A1 describes another spring element which has angled-off ends that snap into recesses in the carrier plate to achieve the resilient connection between the carrier plate and the brake piston. Unfavorably, this also causes the necessity to adapt the spring element to the exact geometry of the carrier plate which limits the range of application and, more particularly, does not permit adjusting the bias of the spring element in a simple fashion.

A pad retaining spring is also disclosed in DE 196 01 435 A1 which is connected to the friction lining by means of a base portion and to the brake piston by means of at least one resilient portion. The base portion bears at least in areas against the side of the carrier plate remote from the friction lining, extends between the carrier plate and the brake piston and engages with the resilient portion into a groove on the front surface of the brake piston. The resilient portions may only be configured to be very short so that their spring characteristics also permits only little variation. The result is that this assembly is susceptible to tolerances.

In view of the above, an object of the present invention is to improve upon a brake pad comprising a retaining spring device in such a fashion as to overcome the disadvantages of the state of the art, especially by providing a solution with a short overall length which ensures a safe attachment of the brake pad to the piston and permits employment in different brake pad designs and different types of contruction of spot-type disc brakes.

This object is achieved according to the present invention because a brake pad for the detachable attachment to a piston of a spot-type disc brake comprises a retaining spring device with at least one spring element which is provided for engagement into a groove of the piston and is secured to the brake pad by means of a retaining element. Preferably, the brake pad comprises a carrier plate and a friction lining fitted thereto, and the retaining element is especially undetachably connected to the carrier plate.

In a first embodiment of the present invention, the retaining spring device comprises only one single spring element which, with at least two spring portions, abuts under spring bias in the groove in the piston or, respectively, is locked in the groove. This permits applying different spring forces to the brake pad, depending on the number of spring portions arranged in the groove. Apart from an axial retaining force which retains the brake pad in abutment on the piston, an additional force component can be applied in a radial direction to the brake pad due to the spring element. This force component in a radial direction, with respect to the brake disc axis, is used to clamp the brake pads, a brake caliper and, as the case may be, a brake carrier with respect to each other in order to suppress undesirable rattle noise. Thus, the retaining spring device fulfils a suitable double function. It can be provided that the spring element has a closed shape. In this case, the spring element can preferably be bent from a wire ring.

As an alternative, it is disclosed in the present invention that the spring element has an open design and includes several spring portions, which are especially separated from one another, which abut in the piston groove and apply differently directed force components to the brake pad. As a whole, the

number of components needed can be minimized favorably by the described variations with only one single spring element.

According to a preferred aspect of the present invention, several spring elements, preferably two or three, are provided which each abut under spring bias in the piston groove. The individual spring elements can have a simpler and thus less costly design by the use of several spring elements. Further, the different functions of the retaining spring device can be split up among the individual spring elements. This permits the well-defined rating and configuration of the spring elements. In this arrangement, two first spring elements which are arranged preferably opposite each other with respect to the piston axis serve for the axial attachment of the brake pad on the piston. Another second spring element applies a spring force to the brake pad vertically to the abutment surface between the brake pad and the piston and, hence, is used for the radial clamping engagement of the brake pad, brake caliper and, as the case may be, brake carrier.

Preferably, the spring element or the spring elements is/are designed as wire spring or sheet-metal spring. This permits a particularly simple manufacture.

Also, it is proposed by the present invention that the retaining element is configured as a retaining member integrated in the brake pad or the carrier plate. The bias of the spring element which acts upon the brake pad can be influenced specifically by way of the design of at least one retaining member or any other point of abutment of the spring element on the brake pad. In addition, retaining members of this type can also be formed on a retaining plate that is undetachably connected to the brake pad or the carrier plate. A favorable design of the retaining members is their

configuration as eyelets or hooks in which the spring element can be attached easily.

In a preferred aspect of the present invention, the retaining spring device is combined with a conventional damping arrangement on the brake pad for noise suppression. To this end, the retaining plate which is undetachably connected to the brake pad and on which at least one spring element is fastened is designed as a damping plate or any other damping layer.

Also, the retaining elements for the spring element can be designed as locking washers. These axial locking washers are preferably fastened on a projection of the brake pad and extend over the spring element for the mounting support. It is preferred that such projections are formed as a punched-through projection or similar elevation on the carrier plate or on the retaining plate.

Special embodiments of the present invention are characterized by that the retaining elements are at least partly inserted into the brake pad or the carrier plate, preferably as an inserted retaining pin or rivet, the said retaining pin or the rivet axially overlapping the spring element and thereby fastening it to the brake pad.

The retaining spring device described is especially suitable due to its functionality and further necessitates only a small axial mounting space. This permits universal application of the retaining spring device of the present invention with different brake pad designs and in different types of construction of spot-type disc brakes, for example, fist-type caliper brakes, fixed-type caliper brakes, electromechanic brakes, combined service and parking brakes, etc.

Further features and advantages of the present invention can be taken from the subclaims and the following description wherein the embodiments of this invention are explained in detail by making reference to the accompanying schematic drawings. In the drawings,

Figure 1 is a partly cross-sectional side view of a brake pad comprising a retaining spring device in the condition of installation in a spot-type disc brake.

Figures 2a-c show three views of a brake pad comprising a retaining spring device in a similar design to Figure 1.

Figures 3a-b show two views of a brake pad comprising a retaining spring device in a second design with a one-part spring element.

Figures 4-5 are two cross-sectional partial views of further variations for the alternative fixation of the spring element on the brake pad according to the present invention.

The brake pad 1 comprising a retaining spring device 7 shown in Figure 1 is illustrated in its installation position inside a spot-type disc brake configured as a fist-type caliper brake 6. The fist-type caliper brake 6 basically comprises a brake caliper 8 which straddles a brake disc (not shown) and brake pads 1 arranged on either side of the brake disc, and a brake carrier 9 mounted fast with the vehicle. The brake caliper 8 with respect to a brake disc axis (not shown) is axially slidably mounted on the brake carrier 9. The brake pads 1 which are arranged on either side of the brake disc are accommodated

in the brake carrier 9 so as to be slidable in an axial direction for the purpose of transmitting brake circumferential forces by way of lateral attachments 10. To actuate the fist-type caliper brake 6, i.e., to press the brake pads 1 against the brake disc, there is provision of an actuating unit with a piston 5, and the said actuating unit is preferably operable hydraulically, mechanically, or electromechanically. For the fist-type caliper brake 6 shown, a first brake pad 1 is moved into abutment with the brake disc directly by displacement of the piston 5, and a second brake lining is moved into abutment with the brake disc indirectly by oppositely directed axial displacement of the brake caliper 8. The brake circumferential forces which occur on the brake pads 1 are introduced directly into the brake carrier 9 formed fast with the vehicle by way of the lateral attachments 10.

The first piston-side brake pad 1 is coupled to the movement of the piston 5 by means of a retaining spring device 7. This retaining spring device 7 essentially comprises two first spring elements 14, 14' and a second spring element 15. The spring elements 14, 14', 15 are locked in a groove 11 of the piston 5 and fastened to the brake pad 1, on the other hand. Further details of the retaining spring device can be gathered from Figures 2a-c.

Figures 2a-c show a piston-side brake pad 1 which comprises a carrier plate 2 and a friction lining 3 fitted thereto. The friction lining 3 is intended for abutment on the brake disc (not shown). A retaining plate 12 is attached, preferably undetachably, e.g. by cementing, on the side of the carrier plate 2 remote from the friction lining 3. In turn, the spring elements 14, 14', 15 are fixed to the retaining plate 12 by means of several retaining members 13. The individual retaining members 13 are in particular designed as hooks or eyelets which

respectively embrace the spring elements 14, 14', 15. With first 16 or second 17 spring portions, the spring elements 14, 14', 15 are arranged under bias in a groove 11 on the piston 5, thereby retaining the brake pad 1 axially on the piston 5.

In an especially favorable manner, the spring elements 14, 14', 15 are bent from simple spring wire portions and can be configured open and in the shape of a closed wire ring. In addition, designs of the spring elements 14, 14', 15 made of spring plate are principally also possible.

The two first spring elements 14, 14' are arranged opposite each other with respect to the piston axis 18. With first spring portions 16 respectively they are locked in the piston groove 11 and apply an axial spring force to the brake pad 1. The brake pad 1 is thereby pressed against the piston 5 and coupled to the piston movement during the brake actuation.

The second spring element 15 acts by means of a second spring portion 17 on the brake pad 1 by way of a force component directed vertically to the piston axis 18. This clamps the brake pad 1 radially with the brake caliper 8 and, thus, also with the brake carrier 9 by way of the piston 5. A rattle-free abutment of the brake pad 1 on the brake carrier 9 is thereby ensured.

The employment of several spring elements 14, 14', 15 permits a separation of functions within the retaining spring device into 'axial pad mounting support on the piston' and 'rattle-free radial clamping engagement of brake pad, brake caliper, and brake carrier'. Further, this permits the rating and configuration of the individual spring elements, as the purpose may be.

Figures 3a and 3b show two views of a piston-side brake pad 1 comprising an alternative retaining spring device 7 for the detachable attachment on the piston. The one-part spring element 4 made of spring wire has a mirror-inverted design and comprises three spring portions 4b, 4d, 4f which are respectively locked by spring bias in a groove 11 that extends on the outside surface of the piston. The two first spring portions 4b and 4f ensure the axial attachment of the brake pad 1 on the piston, as described hereinabove. The second spring portion 4d acts radially upon the brake pad, i.e., vertically in Figures 3a and 3b. Two generally U-shaped portions 4c, 4e are designed between these three spring portions 4b, 4d, 4f and pressed against the carrier plate 2 of the brake pad 1 by way of retaining members 13b, 13c. Spring element 4 still further comprises two free end portions 4a, 4g which extend vertically to the piston axis away from the mirror-inverted first spring portions 4b, 4f and are pressed against the brake pad 1 by means of an eyelet-type retaining member 13a, 13d. On the side of the carrier plate 2 remote from the friction lining 3, a retaining plate 12 is fastened on which the retaining members 13a-d are shaped. Thus, the spring element 4 is retained on the brake pad 1 by way of the retaining plate 12. Preferably, the retaining plate 12 is designed as a damping plate which is varnished, rubberized or coated in another fashion. The result is that one single component takes care of the mounting support of the spring element 4 and the damping function. This damping function is, however, not absolutely necessary for the present invention so that the retaining plate 12 may e.g. be designed as a conventional sheet-metal component part.

The axial connection between the brake pad 1 and the piston 5 is a catch-type connection, i.e., by way of the piston groove 11, or a compression joint, i.e., by way of the retaining members 13a to 13d. The radial spring action is generally

adjusted by way of the shape and the compression of the U-shaped spring portions 4c, 4e and the end portions 4a, 4g.

In general, the retaining members can have a most differing configuration, for example, the shape of a hook, see 13b, 13c, or an eyelet, see 13a, 13d, according to Figures 3a and 3b. In addition, it is possible either to shape the respective retaining members 13, 13a-d on a retaining plate 12, or to integrate them directly in the brake pad 1 or the carrier plate 2.

Besides, the retaining elements can also be configured as separate component parts corresponding to Figures 4, 5 which are undetachably connected to the brake pad 1 or the carrier plate. According to Figure 3, the carrier plate 2 on its side remote from the friction lining 3 has a projection 19 in the form of a sheet-metal punched-through projection on which a separate locking washer 20 makes catch. Such a projection 19 can equally be provided on a retaining plate 12 connected to the brake pad 1. The locking washer 20 is clung on the projection 19 and, additionally, grips over a portion of the spring element 4 which is thereby retained on the brake pad 1.

According to the embodiment of Figure 5, a retaining pin or rivet 21 is fastened in the carrier plate 2 and also extends over the spring element 4 for the mounting support on the brake pad. The attachment of the spring element 4 by means of a locking washer 20 or a retaining pin or rivet 21 can be used particularly without an additional retaining plate. Also, it can be advantageous to configure the retaining members variably in order to permit a variation of the spring bias. A variation of the spring bias can further be achieved by a corresponding shaping of the abutment surfaces of the spring element 4 on the retaining plate 12 or directly on the carrier plate 2. For

example, punched-through projections or other elevations or depressions can be provided on the retaining plate 12 or on the carrier plate 2 for the spring element 4 to bear against. Thus, the desired bias for the spring element 4 can be achieved almost in all directions by suitably configuring the abutment surfaces of the spring element 4 on the retaining plate 12 or on the carrier plate 2.

In general, the retaining spring device 7 makes particularly versatile designs possible by the use of spring elements 4, 14, 14', 15 and retaining elements 12, 13, 20, 21. This permits the universal application of the retaining spring device in different brake pad constructions and different types of spot-type disc brakes.